N.A of said projection optical system.

46. (New) An aerial image measurement unit that measures an aerial image of a predetermined mark formed by a projection optical system, said measurement unit comprising:

an illumination unit which illuminates said mark to form an aerial image of said mark onto an image plane via said projection optical system;

a pattern forming member, which has at least one slit-shaped aperture pattern extending in a first direction within a two dimensional plane perpendicular to an optical axis of said projection optical system which width in a second direction being perpendicular to said first direction is greater than zero, and equal to and under said wavelength λ of said illumination light divided by said numerical aperture N.A. of said projection optical system (λ/N.A.);

a photoelectric conversion element which photo-electrically converts said illumination light having passed through said aperture pattern, and outputs a photoelectric conversion signal corresponding to an intensity of said illumination light; and

a processing unit which scans said pattern forming member in said second direction within a surface parallel to said two dimensional plane in the vicinity of said image plane in a state where said mark is illuminated by said illumination unit and said aerial image is formed on said image plane, and measures a light intensity distribution corresponding to said aerial image based on said photoelectric conversion signal output from said photoelectric conversion element.

47. (New) An optical properties measurement unit that measures optical properties of a projection optical system, which projects a pattern on a first surface onto a second surface, said unit comprising;

an aerial image measurement unit according to Claim 46; and

a calculation unit which calculates said optical properties of said projection optical system based on a photodetection conversion signal obtained upon measurement of a light intensity distribution by said aerial image measurement unit.

48. (New) An exposure apparatus that transfers a circuit pattern formed on a mask onto a substrate via a projection optical system, said exposure apparatus comprising:

a substrate stage which holds said substrate; and

an aerial image measurement unit according to Claim 46 which has an arrangement of said pattern forming member being integrally movable with said substrate stage.

49. (New) The exposure apparatus according to Claim 48, wherein said exposure apparatus further comprises a control unit which measures a light intensity distribution corresponding to aerial images of various mark patterns using said aerial image measurement unit and obtains optical properties of said projection optical system based on data of said light intensity distribution measured.

50. (New) The exposure apparatus according to Claim 48, said exposure apparatus further comprising:

a mark detection system which detects a position of a mark on said substrate stage; and

a control unit which detects a positional relationship between a projected position of said mask pattern by said projection optical system and said mark detection system using said aerial image measurement unit.

51. (New) An exposure apparatus that illuminates a predetermined pattern with an illumination light to transfer said pattern onto a substrate via a projection optical system, said

exposure apparatus comprising:

a self-measurement master on which a plurality of types of measurement marks used for self-measurement are formed; and

a self-measurement master mounting stage on which said self measurement master is mounted, and which can move said self-measurement master close to a focal position on an object side of said projection optical system where said illumination light can illuminate.

52. (New) The exposure apparatus according to Claim 51, said exposure apparatus further comprising:

an aerial measurement unit that includes a pattern forming member arranged within a two dimensional plane perpendicular to an optical axis of said projection optical system on which a measurement pattern is formed and a photoelectric conversion element which photo-electrically converts said illumination light via said measurement pattern; and

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a driving unit which drives at least one of said self-measurement master mounting stage and said pattern forming member when at least a part of said self-measurement master is illuminated by said illumination light and an aerial image of said measurement mark illuminated by said illumination light is formed in a vicinity of a focal position on an image side of said projection optical system by said projection optical system, so that said aerial image and said measurement pattern are relatively scanned.

53. (New) The exposure apparatus according to Claim 52, wherein said measurement pattern includes at least one slit-shaped aperture pattern which width in a direction of said relative scanning is greater than zero, and equal to and under said wavelength λ of said illumination light

divided by said numerical aperture N.A. of said projection optical system (λ/N.A.).

54. (New) The exposure apparatus according to Claim 51, wherein said self-measurement master mounting stage is a mask stage on which a mask having said predetermined pattern formed is mounted.

55. (New) The exposure apparatus according to Claim 54, said exposure apparatus further comprising:

a substrate stage where said substrate is mounted and a reference mark is provided;

an observation microscope to observe a mark located on said mask stage; and

a control unit which performs aerial image measurement of a measurement mark on said self-measurement master using said self-measurement master, said aerial image measurement unit, and said driving unit and calculates a magnification of said projection optical system based on said aerial image measurement on exposing a first substrate of each lot, whereas on exposing a substrate besides said first substrate of each lot, said control unit observes a mark on one of said self-measurement master and said mask and an image of a reference mark on said substrate stage via said projection optical system using said observation microscope and calculates a magnification of said projection optical system based on a result of said observation, when said substrate is exposed by lot.

56. (New) The exposure apparatus according to Claim 51, wherein said self-measurement master is a mask on which said predetermined pattern is formed.

57. (New) The exposure apparatus according to Claim 51, wherein measurement marks formed on said self-measurement master include at least one of a distortion measurement mark of said projection optical system, a repetition mark for best focus measurement, an artificial isolated line mark for best focus measurement, an alignment mark for overlay error measurement with said

substrate.

58. (New) The exposure apparatus according to Claim 51, wherein measurement marks formed on said self-measurement master include an isolated line mark and a line and space mark having a predetermined pitch.

59. (New) An adjustment method of a projection optical system that projects a pattern on a first surface onto a second surface, said adjustment method including:

measuring optical properties of said projection optical system by an optical properties measurement method according to Claim 8; and

adjusting said projection optical system based on a result of said measurement.

60. (New) An exposure method to transfer a pattern formed on a mask onto a substrate via a projection optical system, said exposure method including:

adjusting said projection optical system by an adjustment method of a projection optical system according to Claim 59; and

transferring said pattern onto said substrate using said projection optical system which optical properties have been adjusted.

61. (New) A making method of an exposure apparatus that transfers a pattern formed on a mask onto a substrate via a projection optical system, said making method including:

measuring optical properties of said projection optical system by an optical properties measurement method according to Claim 8; and

adjusting said projection optical system based on a result of said measurement.

62. (New) A device manufacturing method including a lithographic process, wherein exposure is performed using said exposure apparatus according to Claim 48 in said lithographic